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Municipal Journal

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Municipal Journal

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A STUDY OF STREET FLUSHING

Result of Investigation of Rochester Methods by Bureau of Municipal Research—Machine Flushing and Hose Flushing by Contract and by City—Recommendations Concerning Procedure—Sprinkling Methods.

CORRECT WAY OF HOLDING HOSE IN FLUSHING PAVEMENTS.

This is the fourth and last installment of an abstract of a report on street cleaning prepared by the Bureau of Municipal Research of Rochester, N. Y., at the request of the commissioner of public works. The report was made by John T. Child, assistant engineer, under the supervision of James W. Routh, chief engineer of the bureau.

The first installment, in the January 18th issue, dealt with the organization of the force and the keeping of records, with a description of the stables and shop. In the issues of February 8th and 15th were discussed the methods believed most effective for sweeping by hand and by machinery, and the appliances used. In this issue the exact adjustment of flushing nozzles, the water pressure, filling tanks, flushing procedure, hose flushing, and sprinkling of streets are discussed.

DRAGGING HOSE OVER PAVEMENTS WEARS IT OUT.

Water is the best means of removing the fine dirt and dust particles on street pavements which cannot be removed by other means. In its use, however, there appears to be an unfortunate lack of differentiation in the public mind between street sprinkling and flushing. Sprinkling is merely a method of laying dust. In local practice, street sprinkling is done by means of tank wagons from which the water is spread through perforated nozzles by the force of gravity alone. It lays the dust for a short time, but does not wash the street or remove the dirt. On the other hand, the more recent practice of flushing, which is rapidly supplanting sprinkling, is done under a nozzle pressure of from 30 to 70 pounds, by hose or through fan-shaped nozzles on wagon or motor flushers. This method of distribution spreads and directs the water so as to wash the pavement and force dust to the gutters.

So-called flushing done by sprinkling carts is of little value and is more expensive than real flushing performed with a pressure of more than 30 pounds. The work done by 37 such wagons in Rochester in 1917 cost $10,732. The same amount of area could be covered much more satisfactorily by use of four motor flushers at a total cost of $8,200; this including 5 per cent interest and 20 per cent depreciation on a purchase cost of $5,000 each, and labor, fuel and oil. The cost per 1,000 square yards flushed by wagons in 1917 was 26.4 cents, but only averaged 9.6 cents by motor flushers.

Motor flushing is a very satisfactory method of street cleaning, particularly as a finishing touch in removing fine dust particles from the pavements. The very best flushing results can be obtained only where a street has been sprinkled a short time before. The reason for this is that it takes a little time for the dirt to become thoroughly wet and loosened so that it can readily be washed to the gutter. On this account a light rain just before or during the flushing aids in obtaining real cleanliness and should be taken advantage of to save sprinkling. In some cities sprinkling is done regularly in preparation for motor flushing, and this is especially beneficial on block pavements.

In some cities only one man is used per machine. In Rochester, however, it has proved more satisfactory to use a driver and an assistant. The latter makes the hydrant connections and operates the nozzle levers. As the tank prevents the driver from seeing behind when turning or backing the flusher, the assistant protects the apparatus from damage at such times by signaling with a red lantern while standing on the ground or on the side step of the flusher. This is a wise precaution, because the work is done at night, and although there are then comparatively few vehicles, they often are driven recklessly and at high speed.

The drivers' duties should be to drive the machines, to do minor repair work on the engine and pump, to keep a truck record, and to make out daily reports. The duties of the assistant operator should be to fill the tank, to operate the flushing levers and to guard the flusher from accident when turning or backing.

Two motor flushers were being used in Rochester, each with a direct connected centrifugal pump and four nozzles. No. 1 has a tank with capacity of 1,250 gallons and No. 2 of 1,500 gallons; No. 1 has an indicated horsepower of 30 and No. 2 of 40; No. 1 has a speed of 6 to 10 miles and No. 2 of 10 to 15 miles. It takes No. 1 5 minutes to connect to the hydrant, fill the tanks and get away, and No. 2 7½ minutes; and each empties its tank through two nozzles in 3½ minutes. No. 1 uses 7 gallons of gasoline and 1 pint of oil per shift, and No. 2 9 gallons of gasoline and 1 pint of oil. The working pressures on level ground are: Using two nozzles, 18 to 30 pounds, and 30 to 42 pounds respec-

tively; using three nozzles, 18 to 23 pounds, and 26 to 42 pounds; using four nozzles, 10 to 15 pounds, and 22 to 25 pounds. Flusher No. 2 produced very good results, but No. 1's work was not so satisfactory.

The pumps being directly connected to the main shafts, the speed and consequent pressure of the pump is dependent upon the speed of the car. Consequently the flushing is less effective when going up grade. It is therefore suggested that the tank be only partly full when going up grade, or that a less number of nozzles be used.

In flushing asphalt streets, these flushers used 299 gallons of water per 1,000 square yards, and 365 gallons in flushing stone block; and they covered 14,976 square yards per hour (average) of asphalt and 13,191 of stone block. The stone block, however, was not cleaned so thoroughly as the asphalt, because rougher. The stone block pavements were laid on sand with a sand filler, and the sand washed out of the joints and worked up from the foundation. The average cost of labor per mile was 70.53 cents, and the total cost including gasoline and oil, but not including water or overhead, was 90.39; this being per mile flushed, not per mile traveled.

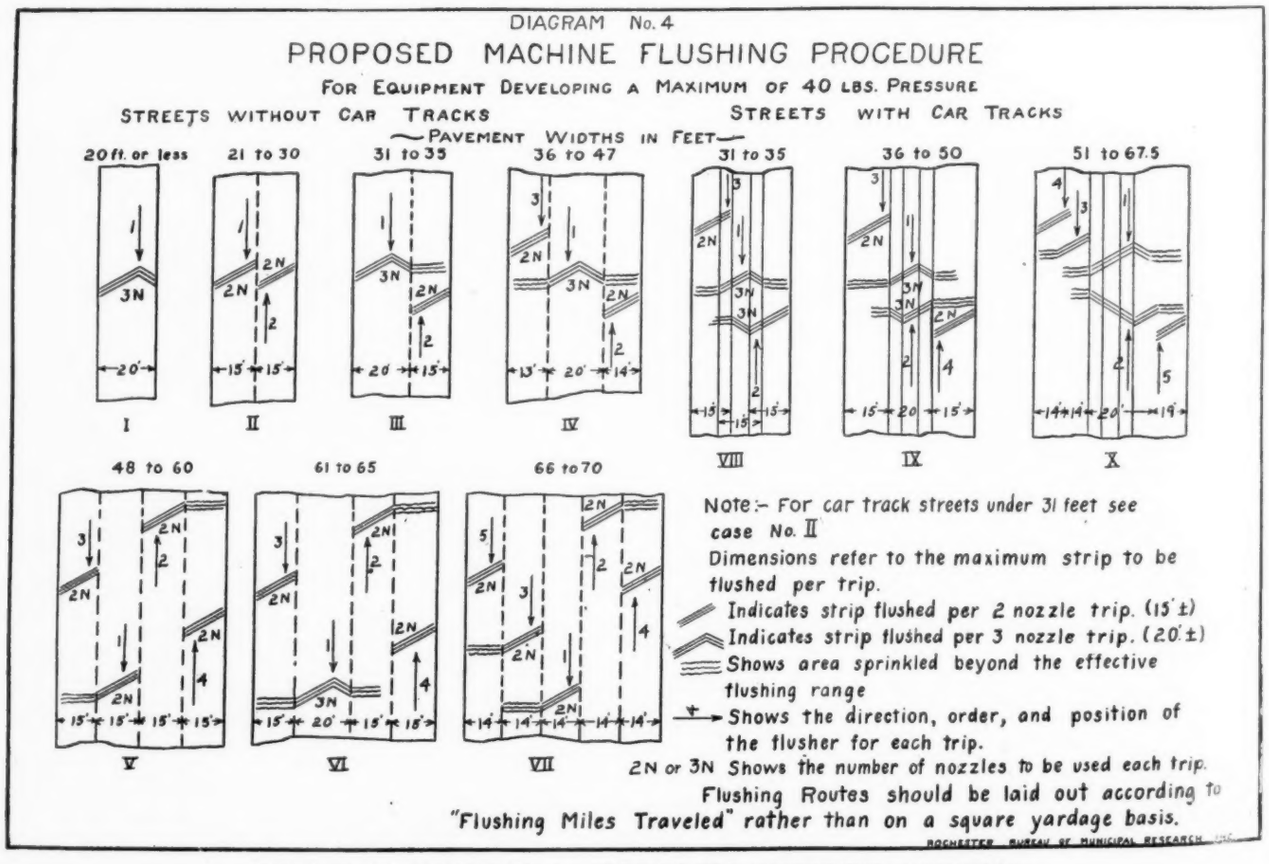
From the study of these flushers the conclusions were drawn that 30 pounds is the minimum pressure that is effective, while 40 to 50 pounds is desirable; that 350 to 400 gallons of water should be used per thousand square yards; that because of the lower speed of No. 1, the operating cost was 28 cents per mile flushed higher than that with No. 2. It was found that, by changing the adjustment of the nozzles, more thorough cleaning could be done, the stroke from the rear nozzles being made to lap slightly over that of the fore nozzles. A strainer on the intake of the tanks was found desirable.

In general, it appears, as a result of tests made, that only two nozzles should be used together on either flusher. In order to save one trip, three nozzles may be used on a narrow street or for flushing the center of a very wide street, if an effective pressure can still be maintained. This qualification is important because it was found that where three nozzles were used together instead of two, less effective pressures, and consequently less side wash, were obtained. The result was that dirty spaces sometimes were left near the center of the street. When four nozzles were used together, water was wasted and, moreover, the nozzles were not all effective, because the two in front interfered with each other and pushed the water straight ahead instead of to one side. The resultant loss of pressure alone is sufficient cause to prohibit the use of four nozzles together at any time, with these machines. A suggested combination of nozzles for different conditions is indicated in the diagram. These diagrams are for motor flushers producing a maximum pumping pressure of 40 pounds. With a higher working pressure, which is desirable, a modification should be made in the diagram, as fewer trips would be necessary to produce the same results.

It was found that by reducing the width of nozzle opening and thus reducing the amount of discharge and so increasing the pressure and velocity of discharge, better results were obtained. Usually only two nozzles should be used at a time, flushing to the right; but sometimes the use of three, one flushing to the left, will permit flushing a narrow street in one trip, or will save a trip on a very wide street.

It is seen that a large part of the time is used in filling the tanks. This could be reduced by using 4-inch intake pipe and hose instead of 2½ inch, using the 4-inch nozzles on the fire hydrants.

Speedometers are not used on flushers on account of



SUGGESTED COMBINATION OF NOZZLES FOR DIFFERENT CONDITIONS.

the vibration, but hub odometers will give satisfactory service and are recommended.

As so large a part of the time is spent in filling, it is recommended that the motor be stopped at such times, thus economizing in gasoline.

The life of hose could be prolonged if more care were exercised in turning on the hydrants slowly, and also if hanging the hose over one hook were discontinued. If possible, the hose should be hung around the tank of the flusher without kinks. (These points are largely matters of instruction and discipline which should be given constant attention.)

Sprinkling the street 15 to 30 minutes before flushing would increase the effectiveness of the results, especially in removing horse droppings, as it would soften up the dirt, which could then be washed off more readily.

It is believed that 1,500 gallons is the largest size tank that can be used on Rochester's streets without detriment to the pavements. Two flushers which could maintain the same speed could be used to advantage in a battery on the wide streets. If this were done, the less frequented streets could be flushed first and the others done in the early morning hours, when there would be no serious delays from vehicular traffic.

It cannot be expected that the best results will be obtained if the work is done without competent supervision in the field. The work done by each flusher should be studied and analyzed under the various conditions to be met, and the work should be planned so as to get the best results possible from each machine.

Burlap spray shields should be used on leaky hydrants and hose to protect pedestrians. Nozzles should be closed when the flusher is stopped by traffic or when horses are frightened. The horn should be blown when approaching vehicles, corners, or people standing near the curb or on the street. Hydrants should not be opened too rapidly, for this damages the hose; they should be closed after use. Damaged hydrants should be reported.

HOSE FLUSHING.

Motor flushing was very satisfactory on asphalt streets in Rochester, but not on stone block streets, especially where there were street car tracks. More trips by flushers would give better results, the flushing strokes lapping further. But the best results on rough pavements can be secured by hose flushing.

Flushing streets with hose is the most widely applicable manner of washing them. Hose can be used to advantage where other flushing apparatus can not. With hose the stream can be concentrated where needed and the quantity of water can be varied by using different sizes of nozzles.

Ordinarily a hose flushing gang should consist of two men, who should serve alternately as nozzle man and hydrant man. This would give both of them flushing practice and prevent either one from getting over tired. A gang of two men, alternating the work of directing and pulling the hose, under ordinary night conditions and with 30 pounds hydrant pressure, can flush clean, on an average, 25,000 square yards of pavement in eight hours. If more than 100 feet of hose are used, three men are necessary to handle it, and where litter is heavy, a man is required to pick up refuse ahead of the flushing work.

The real function of flushing is to wash fine dust from the streets; this cannot be removed by other ordinary means, such as sweeping. Furthermore, snow and slush, and even ice, can be flushed off the street with a 2½-inch hose. In such cases the work should be done under direct charge of a foreman, who should watch the weather conditions and stop the work before freezing begins.

On downtown streets, hose flushing should be done at night, when the traffic is comparatively light and the water pressure high, and when there is the least danger of accidents or complaints from splashing pedestrians or frightening horses.

Good practice indicates that the pavement should be sprinkled with the hose before being flushed, to soak up and loosen the dirt (this can be done by placing the forefinger in the stream to spread the flow); that the flusher should stand astride of the hose and direct the stream with both hands on the nozzle; that flushing should be done down grade whenever possible; that the effective flushing range from the nozzle is usually from six to forty feet, and that the nozzleman should stand near the middle of the street and flush from the center to both sides of the street. Litter should be picked up before and during flushing; if it is light, the flushing gang should do it, but if heavy, an extra man is needed.

It is not to be expected that a large force of hose flushers will be employed on such work all the time; but there are days in the late winter and spring when two men flushing can do more and better street cleaning than twenty men with shovels. Ice can be ripped up from the pavement with a good hose stream, slush and mud can be washed to the gutters in a short time, and the gutters can be opened at less expense than by picking and chiseling. It is believed that hose flushing should be taken up also as a regular summer cleaning practice.

Rough pavements require more water than smooth, and hence large nozzles should be used for cleaning them. Two-inch rubber hose is recommended; except that where the hydrant pressure exceeds 50 pounds 1½-inch hose may be used.

Three-quarter-inch nozzles should be used with 1½-inch and 2-inch hose on all pavements except Medina block or stone, where a 1-inch nozzle with 2-inch hose will give good results. (As stated above, more water, even at the expense of less pressure, is required to flush the rougher pavements.) Shut-off nozzles are too heavy to handle easily, and this, together with their high cost, does not justify their use for this work, except when flushing in traffic. About five pounds is the handiest weight for a flushing nozzle.

The following equipment should be furnished to each hose flushing gang of two men:

Equipment	Approx. Weight Pounds.	Approx. Price (1917).
One hose reel	233	$ 30.00
Three 50-ft. lengths of 2-inch hose at 75 cents	204	112.50
One ¾-inch plain nozzle	5	7.00
One 2½-inch to 2-inch reducer, hand swivel type	1	2.25
One hydrant key and spanner	2½	.15
Two inlet dams	25	
One spray shield	10	
	480½	$151.90

Three men are needed if three lengths of hose are used. Two inlet dams should be supplied to each gang to prevent litter and dirt from being washed down the sewers. These dams can be made by nailing worn-out fibre broom heads together, end to end, and wrapping them with burlap.

Hose should not be dragged on the ground, as this wears it out. It should be unreeled toward the hydrant in connecting up. The full length should be used before changing hydrants. The hose should be strung along

INLET DAM FOR HOLDING BACK DIRT.

the curb, thus lessening the interference with traffic and increasing the distance reached.

The chief factors involved in laying out flushing areas for two men doing hose flushing are (1) the class and amount of traffic, (2) the kind and width of the pavements and location of the hydrants, (3) the water pressure available.

Most of the flushing should be done at night (from 10 P. M. to 5 A. M.) in order to avoid traffic as much as possible. Any kind of traffic hinders the work, and the greater it is, the smaller is the area that can be covered. Motor traffic requires the hose to be deviated for short intervals, but makes little extra work. On the other hand, horse-drawn traffic is slower moving and hence is in the way longer. It is also the cause of more dirt which is difficult to remove.

SUGGESTED PROCEDURE FOR HOSE FLUSHING.

When the gang arrives at the place to begin work, the route should be looked over and the litter picked up. The nozzle end of the hose should be on top of the reel and, when 100 feet from the hydrant, the nozzle-man should take the nozzle end and hold it while the hydrant-man drags the reel toward the hydrant, unreeling the hose along the gutter as he goes. When he arrives at the hydrant he should place the reel on the sidewalk out of danger of being hit by traffic. He then should remove the hydrant cap and secure the hose tightly to the hydrant, making sure that a washer is in the coupling to prevent leakage. He should place the key on the hydrant and turn on the water gradually when the signal is given by the nozzle-man. While the hydrant-man is connecting up, the nozzle-man should see that the hose is free from kinks. Then he should take up a position in the center of the street at the full length of the hose from the hydrant and when ready (with nozzle valve open to allow air to escape, if the nozzle is shut-off type), he should signal the hydrant-man to turn on the water.

The hydrant-man should turn the key slowly in the direction indicated by the arrow on the hydrant. If the key does not turn fairly easily, it should not be forced; that hydrant should be abandoned and the fact reported to the superintendent when he appears. (Forcing a hydrant open may break the stem. Turning on water too suddenly may damage the water system or hose or throw the nozzle-man off his feet.) If hose or hydrants leak, a burlap spray shield should be thrown over the leak. When the water is turned on, the hydrant-man should help the nozzle-man by picking up a loop of hose and taking the weight of it from him when moving.

The nozzle-man should start work by spraying the pavement for a distance of about 100 feet from the nozzle. (Spraying can be done by holding the forefinger in the stream.) By turning in his original position, the nozzle-man should spray all the pavement within reach of the stream, unless the pavement is already wet from rain or sprinkling cart. This spraying softens hardened refuse that sticks to the pavement. As little water as possible should be used for this purpose.

After spraying from one position, flushing should be done in the same line that the spraying was done so as to give as long a time as possible for the dust to become soaked. Flushing should be done from the center of the street to the sides at distances varying from four to sixty feet from the nozzle. The stream should be swung back and forth and be raised so as to force the mud wave to the gutter. When one section is flushed, the next should be sprayed ahead as far as possible. Under usual conditions the stream will reach 100 feet or so, but effective flushing can be done only for about 60 feet. When nearly finished with one section, the nozzle-man should send the hydrant-man to the hydrant. When finished, a signal to shut off the water should be given.

The hydrant should be turned off slowly and the hose uncoupled. If the hydrant does not drain properly, something may be under the valve. In such a case the valve should be opened and shut several times, if necessary, to wash it out. If it still does not drain properly, the superintendent should be notified on his next round. The cap should then be replaced and the hose reeled up from the hydrant toward the nozzle, the reel dragged toward the next hydrant and the hose unreeled as before.

When flushing, the stream should be kept behind the dirt wave at all times and the dirt flushed to the gutter as fast as possible. Flushing should be done in the direction of the down grade and with the wind whenever possible. When using a shut-off nozzle, the water should be turned off when not in use or to avoid traffic. It should be turned off slowly.

When the work is finished, the hose should be drained before final reeling. This can be done best by two men raising the center first and then each man working toward one end. Equipment should be checked up before leaving the job.

Ordinarily flushing hose lasts from eight months to a year with daily use, depending on the care which is given it. Its life is lengthened if kinks are kept out of it, and if care is taken in reeling the hose and in turning on water to full pressure. The men should be instructed in the proper manner to care for hose, and supervision should be provided to prevent carelessness and failure to follow instructions.

The flushers should be taught to increase the life of the hose by mending breaks. A simple method of mending tears and leaks in flushing hose is by winding them with bicycle tape and then lacing on pieces of old hose to take the wear. Also an easy means of reducing the wear from dragging the hose is by wiring several rings of old garden hose at intervals on each 50-foot length. The old garden hose probably can be obtained from collected rubbish, and repairs can be made at the section headquarters by the janitors. These simple expedients not only prolong the life of hose and thus save money, but do away with much inconvenience and time lost when new hose is not to be had when needed.

STREET SPRINKLING.

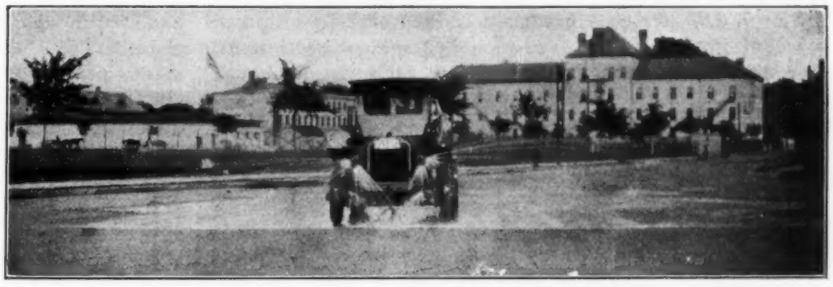
Street sprinkling is valuable in preventing dust from blowing about, especially on macadam; but not as a method of cleaning. It is also desirable in advance of flushing, as described above. It is seldom done intelligently, but is frequently omitted when and where most desirable and performed where unnecessary and even detrimental.

In Rochester it was found (and would probably be

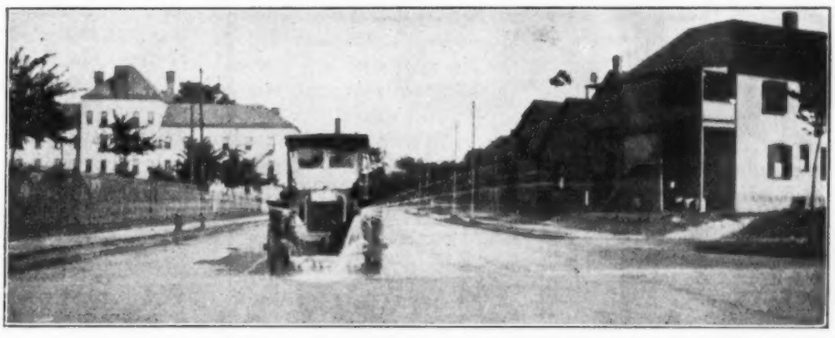
found in many other cities): (1) That continually keeping car tracks wet is detrimental to both the track paving and rail maintenance and therefore to car service; (2) that over two-thirds of the sprinkling is done on paved streets with no real cleaning results; (3) that no control is exercised over the work by officers of the street cleaning force; (4) that sprinkling when done should be in conjunction with street cleaning work; (5) that it rains an appreciable amount on more than 40 per cent of the days in the sprinkling season; and (6) that sprinkling on unpaved streets as now practiced is detrimental to the sewers and to macadam streets.

Performance tests were made of sprinkling with the motor flushers, the sprinkler nozzles being set at different angles. Some of the tests are shown in the accompanying illustrations. The best distribution was obtained when the nozzles were set with the top holes at the same level on both sides and the pressure between 15 and 20 pounds. When the nozzles spread more than 20 feet the distribution was poor and the quantity of water insufficient.

The best sprinkling results with flusher No. 1 were obtained when the pressure was 12 to 20 pounds, speed 6 miles per hour, width sprinkled not over 18 feet for one trip or 30 feet for two. With flusher No. 2 when the pressure was 15 to 20 pounds, speed 7 miles per hour,



SPRINKLING NOZZLES USED TOGETHER.
Most of the water is spread under the machine; the rest is poorly distributed and insufficient in quantity.



EXTREME SETTING OF BOTH NOZZLES.
Sprinkles 30 to 40 ft. strip; very poor distribution of water and alternate wet and dry spaces. Constant danger of wetting pedestrians. Most water concentrated under machine.

BEST SETTING FOR ONE NOZZLE FOR SPRINKLING.
Sprinkles 15 to 20 ft. width.

and width sprinkled not over 24 feet for one trip or 42 feet for two.

BREAKING UP CONCRETE PAVEMENT WITH DYNAMITE.

In the city of Warren, Pennsylvania, recently, contractors were tearing down an old suspension bridge built in 1873 to replace it with a modern concrete bridge. Stone abutments ten feet thick, fifty feet long and twelve feet high anchored the ends of the cables, and a concrete pavement, twelve inches thick, 8,700 square feet in area, formed the approach to the bridge.

Breaking up this masonry and concrete construction was a problem. The contractors hesitated to use dynamite because the bridge was in the heart of the city, houses were located within fifty feet and pedestrians and vehicles were passing continually. However, blasting was finally decided on, but instead of using large charges of dynamite to break up large sections of the material every shot, the blaster adopted what is known as a nibbling method; that is, bore holes were put down in the concrete or cement between the stones, which were loaded with small charges consisting of quarter-pound loads of forty per cent dynamite well tamped into each hole. Each charge broke out chunks six to eight feet long and of varying widths. Not the slightest damage was done to adjacent buildings. Not a window was broken. No pedestrian was even startled.

In this way, the work was done much more quickly than would have been possible had laborers with sledge hammers and drills been used, and labor cost was saved. Only thirty pounds of dynamite was necessary to complete the entire job.

BINGHAMTON SAND CATCHER.

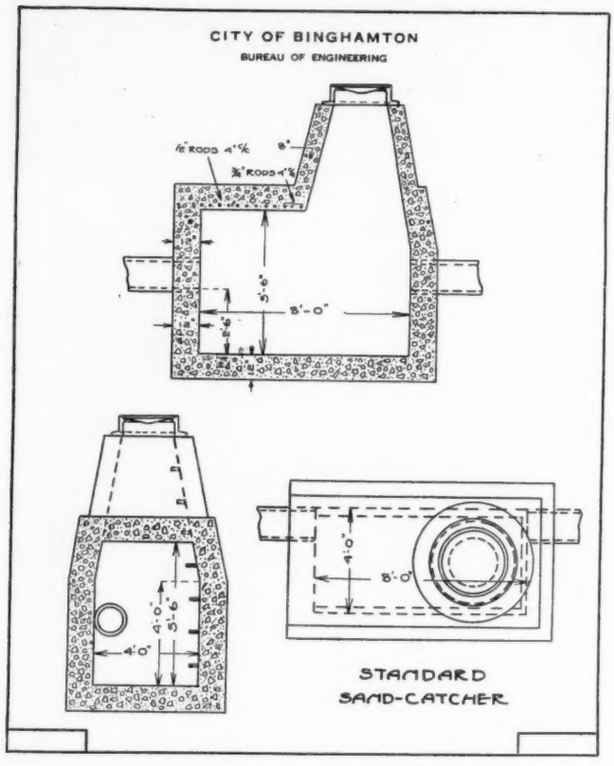
Tried Out Successfully for Preventing Deposits in Sewers with Flat Grade and Poorly Designed—Adopted as Standard.

By W. EARL WELLER.*

In all recent literature on the subject of sewer design the matter of sand catchers is discussed very briefly if at all. The tendency is towards details that will prevent the introduction of sand and grit into the sewers and towards the maintenance of self-cleansing velocities should these details prove inadequate. The soundness of these principles is beyond question, but occasionally the municipal engineer is confronted by an existing condition which calls for a remedy. If this condition happens to concern a sewer which is frequently choked by deposits of grit, the question of a sand catcher located at some strategic point in the sewer itself merits consideration.

*City engineer of Binghamton, N. Y.

One of the older sewers in Binghamton, dating from the days of aldermanic control, has, owing to poor design, been the cause of considerable expense. The sewer in question consists of an 18-inch vitrified tile section laid on a 3.07 per cent grade; a 22-inch section on an .8 per cent grade and a 15x22-inch egg-shaped section on a .2 per cent grade. The various sections discharge



BINGHAMTON'S STANDARD SAND CATCHER.

into each other in the order named. It will be noted that the capacities of the various parts of the line decrease as we approach the discharge end. Further complication is caused by a poorly designed junction with a larger egg-shaped sewer. The combination results in a choked sewer which in turn causes flooded cellars during even light rains.

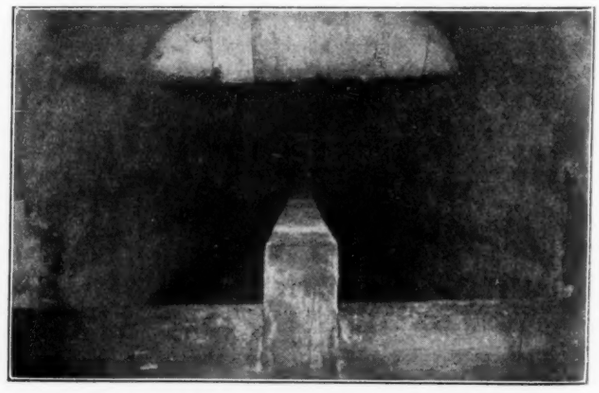
As soon as possible after every severe storm it has been necessary for the department to detail a gang of five men from the Bureau of Sewers for the purpose of removing the deposit. In a period of six weeks during the season of 1918 this gang was twice called upon to clean the lower 700 feet of the sewer. The work was done with a sewer cleaning machine of the drag bucket type and required seven days on the first occasion and six days on the second at a total cost of $124.25 and $104.75 respectively. These figures make the actual cost, neglecting supervision and the rent of the machine, 18.6c and 15.7c respectively per linear foot of sewer cleaned. These two expenditures (which gave every promise of being repeated) and the complaints of disgruntled residents regarding sewage-flooded cellars caused the city officials to seek a more satisfactory arrangement and it was practically decided to replace the sewer with another that would not lightly disregard all the canons of sewer ethics.

Before adopting such a drastic remedy it was decided to try the efficacy of a grit chamber in the existing sewer. Consequently there was constructed in the 15-inch by 22-inch section, near its junction with the 22-inch section, a grit chamber 3 feet deep, 5 feet wide and 5 feet long. This chamber was built of brick on a concrete base 12 inches in thickness. The walls were 8 inches in thickness and were covered inside and outside with a thick plaster coat. Access to the chamber is had by means of a standard manhole opening. The chamber was constructed by employes of the department and cost approximately $60. It can easily be cleaned by two men in less than a day at a total cost, including disposal of the removed material, of about $7.50. It has been planned to clean the chamber after every heavy storm. It is apparent from the cost figures given above that, if the appliance is successful only in cutting the required number of cleanings in half, it will easily have earned about 50 per cent. on its investment after just one storm.

The results have been so satisfactory that at least one other sand catcher will be constructed in another troublesome sewer in the spring. In the new chamber the walls, or at least that portion of the walls below the level of the sewer invert, will probably be built of concrete. The length will be increased to 8 feet and the depth decreased to 2 feet. The design will be standardized and added to the sewer standards of the city. The department does not pride itself on a new discovery but believes that it may have hit on the reapplication of an almost-forgotten kink. It might be mentioned in closing that all storm water inlets in Binghamton are of the standard sand-catching basin type but the velocity of the entering water on some of the steep grade streets rather negatives their silt catching propensities, resulting in the previously mentioned deposits in the sewer proper.

SAN FRANCISCO SETTLING CHAMBER.

San Francisco has employed a type of settling chamber for intercepting heavy sediment that is carried by the sewage flowing in a large combined sewer. The chamber consists of an enlargement in the width of the sewer and a drop of two or three feet. A special feature is a central wall that divides the settling basin into two equal channels, the object of which is to facilitate removal of the deposited matter. During the dry season the material that has settled in the basin is removed, one side being cleaned at a time by placing at each end, between the division wall and one side wall, a dam of sand bags which diverts the dry-weather flow through the other side or channel; the dam being then moved to the other side of the central wall to permit cleaning that side of the basin. The material is taken up in buckets through a manhole. In the illustration a ladder at the manhole can be seen faintly in the distance. At the top in the foreground is seen a steel pipe crossing through the arch of the chamber.



SAN FRANCISCO SETTLING CHAMBER.

GUARANTEES FOR PAVEMENTS

Report of Committee of American Road Builders' Association at Its Recent Convention—Guarantee Period of "Reasonable Life Without Repairs."

In view of the looseness with which the terms "Guarantee" and "Maintenance" are often applied to paving contracts, your Committee, in discussing the subject assigned to it, wishes to make clear that it believes the two terms should be regarded as separate and distinct and that the guarantee period should not be longer than the reasonable life of the pavement without repairs, except those rendered necessary by reason of defective materials or workmanship or both.

This is in accord with numerous court decisions in connection with assessment work and automatically settles the question of legality and at the same time clearly indicates the maximum period which should be called for in a guarantee. Your committee recommends that this maximum period should be fixed at 5 years.

Three types of guarantees are in common use:

a. Bond—preferably from a surety company.

b. Retention by the municipality of a certain amount of cash.

c. Bond and retained percentage.

The intent of the guarantee is to guard against defects in material and workmanship and non-compliance with the specifications, but in many cases defects may develop in the pavement or roadway which are due to other causes and conditions which may have been entirely outside of the scope of the contract.

It is apparent, therefore, that the responsibility for a satisfactory and lasting pavement is shared by both the engineer and the contractor. With the engineer rests the responsibility for providing proper drainage and adequate foundation and the selection of a suitable type of pavement and the preparation of comprehensive plans and specifications. He must also provide such inspection as is necessary to insure strict compliance with the specifications.

With the contractor rests the responsibility of carrying out in a satisfactory and workmanlike manner the plans and specifications and instructions of the engineer.

The safeguarding of the public welfare lies, therefore, in the hands of the two parties above mentioned with the following possible exceptions:

In a number of instances pavements have failed due to causes which may or may not have been controllable by the engineer or the contractor:

Defective street railroad construction;
Settlement of trenches for underground service pipes;
Improper system of cleaning the pavements;
Leaky gas or water mains.

The engineer is directly responsible to his community and if he is negligent or incompetent he should, and presumably can, be removed. Generally speaking, the question of public welfare or economics in this connection is not directly involved in the guarantee clause of a contract except in those cases where an incompetent or negligent engineer has prepared faulty specifications and as a consequence thereof has asked a contractor to guarantee a pavement which is liable to fail through causes other than defective materials and workmanship.

Assuming that the plans and specifications are entirely competent and proper, the next duty devolving upon the engineer is that of inspection, which includes testing of the materials to be used. This requires a laboratory equipped for physical and chemical testing and the services of some one who has made a specialty of testing paving materials, as such work does not come within the scope of an ordinary chemist. Most states and a number of the larger cities maintain their own laboratories and testing staff. Smaller municipalities may and frequently do avail themselves of consulting and testing experts, but a certain proportion of them do not and, on the contrary, permit their pavements to be laid with only such supervision and inspection as their engineers can personally give to the work, and in many instances these engineers are not well qualified in this particular line and would gladly avail themselves of expert help were they permitted to do so.

In addition to the preliminary testing of materials, provision must be made for the inspection of the work as it progresses. Where the pavement is manufactured in a plant and then delivered to the street, inspection at both the plant and the street is essential. For example; in the case of a large asphalt plant where 200 to 300 batches of mixture are sent out daily involving 600 to 900 separate weighings, a rigid inspection, such as would justify the total elimination of a guarantee clause, would require two inspectors. The preparation of the subgrade, the mixing and laying of the concrete base, and the laying of the wearing surface would similarly require two or three inspectors and these must all be trained men, not haphazard appointees.

From the standpoint of a municipal engineer this is a very serious problem. His reputation, as judged by the lasting qualities of his pavements, might often rest in the hands of inspectors whose appointments and qualifications were entirely outside his control.

In the abstract, it has been justly said that with competent inspection, guarantees could and should be entirely eliminated, but from an economic standpoint there remains the question of cost of sufficiently adequate inspection and the difficulty of securing it.

The drawbacks and defects in the guarantee system are too well known to require elaborate discussion in this report, but it is a fact that present inspection systems have been devised and carried out with a view to providing reasonable (but not absolute) security, having in mind the certain or uncertain amount of additional protection accruing from the guarantee clause inserted in almost all paving contracts. If this is to be abolished the inspection must be made more rigid and therefore costly, and the lines must be drawn more tightly than heretofore both as to materials and workmanship.

Engineering is not an exact science insofar that in all cases a certain factor of safety must be employed, and there is no such thing as a hair-line division between good and bad. When the results are guaranteed, even though the guarantee is far from perfect, it is human to require a somewhat lower factor of safety than would otherwise be insisted on. Where the contractor assumes no responsibility for his finished work, the inducement to slight it and thereby save money is greatly increased and the inspecting force must be still more competent, vigilant and trustworthy than would otherwise be necessary.

The cost of a guarantee bond to the average contractor does not exceed 1 per cent of the total cost of the contract. On a pavement costing $3.00 per square yard this would amount to 3 cents per square yard, which would barely cover the increased cost of inspection above described without taking into consideration at all the increased bidding price likely to result from increased severity of inspection.

Assuming that the guarantee is only for the normal life of a pavement without repairs, there exists no legitimate reason for the contractor to increase his construction bid by more than the cost of his bond.

As between a reliable and established contractor and one who is lacking in experience, resources and equipment, it is easier and cheaper for the reliable contractor to secure his bond and this can only be regarded as a legitimate advantage to him. As a general rule, he will favor a guarantee bond.

Where contractors do not have an established plant or organization in the municipality or locality where the pavement is being laid, some guarantee for the repair of such defects as may develop would seem to be a necessity. In many smaller towns a single contractor may remain for two or three years and then withdraw after the available paving area has been completely improved. It may be years before any new paving is done and it is often very difficult to get the contractor to return and make any repairs during the guarantee period.

It is sometimes claimed by the contractor that where the specifications are closely drawn and compliance with them is insisted upon, he should be relieved of the responsibility of guaranteeing results. Your committee believes that after having examined the site of the improvement and studied the specifications he is or should be fully familiar with conditions; and if, after doing so, he signs the contract and guarantee, he has no reasonable ground for subsequently opposing the engineer in his desire to carry out the provisions of the specifications and that such insistence on the part of the engineer does not and should not relieve the contractor of his guarantee obligations.

If he believes the specifications are faulty, he is under no compulsion to bid on the work, and if he does so, he acts with his eyes open and has no one but himself to blame. The history of court decisions would appear to show that the contractor is at least as well protected as the city when the matter comes up for legal adjudication.

We also recognize that certain large cities may have within their confines three or four large paving plants and that conditions are such that it may be difficult for an outsider to break in. In such cases it is possible to imagine an arrangement between bidders whereby the city would pay excessively for their guarantees, but such conditions are exceptional ones and under them the same city would probably pay an excessive price for its pavements even if it eliminated the guarantee provision from its contracts. This condition could be and has been met by the establishment of large municipal plants capable of doing a considerable portion of the necessary paving.

It has also been urged that it is not logical or legitimate to ask for guarantees on pavements because buildings are not guaranteed. The cases are not parallel. The factor of safety in a building is much greater and its life expectancy is much longer. If the average life expectancy of a building were but ten years and defects might be expected to develop within five years, which might render it useless unless rebuilt, the cases might be more nearly parallel.

Having in view the facts as set forth in this report, your Committee believes that, notwithstanding its admitted defects, the guarantee clause serves an effective purpose and in the light of experience is economically justified.

We do not believe that a uniform length of guarantee for all pavements or for the same pavement under varying traffic conditions is logical or justifiable. Certain pavements are composed of blocks which in themselves have a very long life, and but little variation is to be looked for in the blocks themselves. Defects which would develop would be almost wholly defects of workmanship and two years should be the maximum period required to make this evident, and therefore, the guarantee should be limited to that time. Other pavements are composed of blocks which vary very greatly in hardness and resistance to wear and for this type we would advocate a guarantee period for the full life expectancy of the pavement without repair, as it is obviously impossible to test every block used in it. Where a pavement ultimately fails through the abrasion or disintegration of the pavement itself and is liable to prematurely disintegrate through improper materials, or mixing, or proportions, we believe that, owing to the great difficulty of absolutely preventing these errors by inspection, the pavement should be guaranteed for its full life expectancy without repairs and this can be reasonably varied to meet different traffic conditions.

We believe that the guarantee clause should be fairly worded so as not to impose upon the contractor responsibility for conditions arising after the completion of the pavement and over which he had no control, and as covering these points would recommend for consideration the form adopted by the Association for Standardizing Specifications at New Orleans in January, 1912. It should also clearly set forth and be agreed to by the contractor that he accepts the guarantee as being within the reasonable life expectancy of the pavement without repairs.

In northern latitudes if the pavement is completed and accepted between November 1st and May 15th, the guarantee period should be extended so that it will expire on the first of June first following, in order to insure weather conditions being such as to permit of thorough examination and the making of all necessary repairs before the final taking over of the pavement by the city. This provision may be omitted when climatic conditions render it obviously unnecessary.

Owing to the admitted defects and short comings of guarantees covered by surety bonds alone and the frequent difficulty experienced by cities in having even those repairs due to poor workmanship and materials made on time, we believe that the bond should be supplemented by a cash retainer, legal interest being allowed to the contractor on the amount retained.

For new construction involving grading, foundation and wearing surface we would recommend that 10 per cent of the aggregate cost of these items be retained.

For surfacing on an old foundation we would recommend a retainer of 20 per cent.

In the case of a 2-year guarantee the whole of the retained moneys should be payable at its expiration and not before. In the case of a 5-year guarantee, one-fourth of the retained moneys should be payable two years after the completion of the pavement and the balance in three equal annual installments. The date when payments of retained moneys become due shall be governed by the clause previously recommended for pavements completed and accepted between Nov. 1st and May 15th. If the contractor, having received 30 days' notice, fails to make and complete the ordered repairs at the time any annual installment (or the whole amount) of the retained moneys becomes due, he shall forfeit to the city the total amount then due unless he shall have obtained in writing from the engineer an extension of the time, when the same provision shall apply at the expiration of the extension period.

Francis P. Smith, chairman; J. F. Hill, C. M. Pinckney, B. H. Wait, T. J. Wasser, members of the committee.

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A. PRESCOTT FOLWELL, *Editor*
SIMON BARR, *Assistant Editor*
CHARLES CARROLL BROWN, *Western Editorial Representative*

Telephone (New York): Bryant 9591
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PAVEMENT GUARANTEES.

The report to the American Road Builders' Association of the committee on "Economic Status of Guarantees for Pavements on Roads and Streets," which is published in another part of this issue, was the subject of animated discussion by the convention and did not seem to meet with very general favor from the contractors present. It seems to us, however, that most of those discussing it did not fully appreciate the aim of the committee. Whether, understanding and agreeing with that aim, they would indorse this form of guarantee as attaining it is still an open question.

Briefly, we understand that the committee's idea was to limit the guarantee period to that necessary for detecting any features of workmanship or material that were not up to specification, and thus provide for only such repairing as might be called for by such defects. The committee specifically states that "it believes the two terms ('guarantee' and 'maintenance') should be regarded as separate and distinct, and that the guarantee period should not be longer than the reasonable life of the pavement without repairs except those rendered necessary by reason of defective materials or workmanship or both."

If there is to be any guarantee at all, one based on these premises would seem to be logical and just to the contractor. There remain for difference of opinion the question of guarantee vs. rigid specifications and inspection, and that of the method of applying this principle of guarantee. The former will form the subject of an article that we shall publish, probably next week.

As to the committee's idea concerning what is the "reasonable life of a pavement without repairs," they give five years as a maximum life, but believe that the period should vary with the kind of pavement and the traffic condition. In the case of certain block pavements, defects would be almost wholly those of workmanship and should develop within two years, and the guarantee would be limited to that time. But for those block pavements in which the blocks vary in hardness and resistance to wear and therefore might themselves be defective in spots, and for pavements that ultimately fail through abrasion or disintegration of the pavement itself, the duration of the guarantee should be full life expectancy without repairs, varied to meet traffic conditions. How to assign a definite period to this "reasonable life without repairs" that shall "vary to meet different traffic conditions" needs further elucidation, which will probably be given at the next convention, this having been accepted as a progress report. The assigning of a period that shall be fair to both parties and provide for increase in traffic seems to present serious difficulties. Possibly the use of a traffic census taken at stated intervals may be adopted in this connection, the guarantee period being a function of the traffic carried.

Considerable opposition was aroused by the last suggestion of the report, that a cash retainer be added to the bond, 10 per cent on new work and 20 per cent on resurfacing. The question is raised ,if surety bonds are so unreliable, why ask for them at all?

The committee is, we fully believe, anxious to develop a system of guaranteeing that, while it secures a good pavement to the city, will also be fair to the contractor, and will undoubtedly be glad to receive suggestion that will help toward the solution.

MUNICIPAL REVENUE AND REAL ESTATE TAXES.

The following letter from the director of the Bureau of Industrial Research of Indianapolis is self-explanatory. In the article in question, taxes on "real estate" are referred to a number of times, and only once is reference made to "land" taxes, which was a slip that escaped our notice. Although we do not admit that it expresses an incorrect idea, it at least does not cover the whole idea, in that the taxes are levied on buildings as well as on land. With this correction, we have no apologies to offer for the article. We did not intend to advocate or oppose any particular scheme of taxation, but only to set forth what different cities are doing. We realize that in general all taxes are paid by the ultimate consumer, different distributions of taxes, however, varying the allotment of the total amount of taxes among such consumers.

Municipal Journal, New York.
Gentlemen:

Please permit me to call your attention to your article on "Increasing Municipal Revenue," which appeared in the Municipal Journal for February 15, 1919, and to suggest that the writer of that article makes some very important observations which are by no means universally accepted as sound economics.

Specifically, on page 129, reference is made to the increase in the per capita tax collected from real estate since 1903, which has resulted inevitably in *"an increase in rent and in the cost of carrying on every kind of business, since all of these directly or indirectly pay the land taxes."* What we have here is the all too prevalent fallacy that rent enters into the price of commodities in exactly the same way and to the same extent that delivery or selling costs, for example, enter; whereas, to class rent in the same category with other costs is to confuse thought and lead to erroneous conclusions, exactly as it has done in the particular case under examination.

Note, for example, how this fallacy creeps into the last sentence of the paragraph from which the quotation previously made was taken. Here is a plea against heavier taxes on real estate, on the ground that an increase in such taxes would increase the burden of rent now imposed on the laboring classes, who are *"those least able to afford to pay them."*

Now, as a matter of accuracy, the writer should have distinguished between taxes on land and taxes on buildings or other improvements which are distinguishable from the land.

It is the rent of the latter only that is increased by taxation, through the effect of taxation on the supply of such goods; and these are the only real estate taxes that enter into the rents paid by laborers or by any one else. If cheaper rentals for laborers are desired, they can be secured, not by decreasing

the tax on land, but by increasing it, and by a corresponding deduction from the tax on improvements.

Another apparent slip appears on the same page, page 129, second column, second paragraph, where the writer cites with evident approval the fact that Birmingham secures 19.1 per cent of her revenue from business licenses. Can it be that such taxes, unlike taxes on real estate, do not enter into the costs of doing business, and hence are not shifted to the consumer and thus "unloaded so directly onto those least able to afford to pay them"?

Students of the tax problem generally admit that a tax on economic rent, the annual use value of land, cannot be shifted, and that every tax which must be paid out of the profits of business only makes the conduct of business more expensive and hence, in the majority of cases, adds to the price paid by the ultimate consumer. It is to be regretted that the writer of the article referred to did not have these two principles clearly in mind. If he had, he would not have implied such an unfavorable comparison between Des Moines and Birmingham. Of all the sources of additional municipal revenues, economic rent seems to offer the most hopeful possibilities.

Very truly yours,
RAY S. TRENT,
Director, Bureau of Industrial Research.

Twenty-five or thirty years ago, as an enthusiastic student, we read and listened to the words of Henry George. Since then enough has been written on his theories to fill a library. The limited space in Municipal Journal does not permit us to add to this literature, interesting as it would be to do so. As stated, we had and have no intention to express an opinion on the subject, but only to enable cities to learn what sources of revenue other cities are utilizing that they are not.

SPRINKLING FILTER FLIES.

Drowned by Flooding Filter Beds for Twenty-four Hours—Satisfactory Experience with This Method at Plainfield, N. J.

One of the objectionable features connected with sprinkling filters is the prevalence at most of them, during certain seasons of the year, of myriads of small flies. This fly is small and moth-like, 3 to 5 mm. long, the body and wings covered with fine hair. Millions will breed in a filter during a season. They may be carried by favorable winds three-quarters of a mile from the plant, but generally remain rather close to it. Ordinary window screens do not keep them out.

The result of experiments conducted at the sprinkling filters of Plainfield, N. J., was set forth by C. S. Beckwith, assistant entomologist of the New Jersey State Agricultural Experiment Station, in a recent issue of "New Jersey Municipalities." His statement was as follows:

In studying the habits of the flies it was determined that the breeding continues throughout the entire season. During the cold months they are present in the larval and pupal stages, emerging with the coming of warm weather. The abundance of the flies during the warm season seems to be correlated with the thickness of the film on the stones of the filter. A thick film means more flies, and a thin film, fewer flies. The thick film of late spring gives rise to a tremendous brood. After the film has broken down and sluffed off the number is greatly reduced. Again with the thickening of the film in late summer, the flies become abundant.

A study of the problem showed that under a temperature of 70 degrees Fahrenheit the fly requires from eleven, seventeen to nineteen days to complete its entire life cycle, distributed as follows: Egg stage 32 to 48 hours, larval stage 9 to 15 days and pupal stage 20 to 47 hours. These determinations were made under controlled temperature conditions, and the change in position of the stone on which the immature stages were located might either shorten or lengthen the period. It seems probable, however, that the effect of artificial conditions was principally shown in the variation in length of time above indicated. On the filter beds the completion of the life cycle may require much more time in lower temperatures or considerably less time in higher temperatures.

The study demonstrated that the control of the pest by the destruction of the adults was impracticable and that the attack must be made during the immature stages. The study also showed that in the larval and pupal stages the organisms live imbedded in the film and that during both stages they thrust their breathing tubes through this film to obtain atmospheric air. The problem of control was thus resolved into one of finding an agent which would destroy the larvae and pupae and not injure seriously the film on which the efficiency of the filter bed depends. A large number of chemicals were tried. Any of these, when usd in sufficient strength to kill the fly, also damaged the film.

In holding over samples of sewage filter film, Dr. T. J. Headlee unthinkingly covered them with water. When he examined the material the following day he found larvae and pupae dead, although other parts of the film seemed normal. This accidental observation, when correlated with the fact that the breathing tubes of maggots and pupae project through the film in such a way as to obtain atmospheric air, led to suspicion that the species could be controlled by drowning. The following table is the compiled result of three sets of experiments.

Results of Submergence Tests on Sprinkling Filter Fly.

Length of Time Flooded, Hrs.	Conditions of Larvae and Pupae	Condition of Film
16	Alive	Alive*
18	Alive	Alive
22	95% dead	Alive
24	Dead	Alive
32	Dead	Alive
36	Dead	Slight putrefaction
48	Dead	Putrefaction

*Organisms which largely compose the film alive.

It thus seemed that submergence for 24 hours destroyed 100 per cent. of the larvae and pupae.

To make the matter more certain, one-fourth of the Plainfield sprinkling filter, amounting to a little less than one-half acre, was submerged for a period of 24 hours with ordinary sewage water as it came from the dosing tank. At the end of this period the water was released and many samples were taken. Enormous numbers of larvae and pupae came out with the water, and not one could be found that was alive.

The sprinkling sewage filter beds at Plainfield have concrete containing walls with two outlet chambers leading across it. A permanent fixture permitting quick flooding was arranged by placing a weir furnished with a gate across the lower end of each outlet. During 1918, no serious brood of flies escaped from the filter bed, which, during parts of the summer, was flooded every ten days. The sprinkling filter fly can be controlled practically as well as experimentally by flooding the filter bed with sewage water for a period of 24 hours.

NEWS OF THE SOCIETIES

March 12.—VERMONT SOCIETY OF ENGINEERS. Annual meeting, Burlington, Vt. Secretary, Geo. A. Reed.

March 25, 26.—AMERICAN WATER WORKS ASSOCIATION, ILLINOIS SECTION. Eleventh annual meeting, Urbana, Ill. Secretary, G. C. Habermeyer, acting chief, State Water Survey, Urbana.

April 14-19.—UNITED STATES GOOD ROADS ASSOCIATION. Annual convention, Mineral Wells, Tex. Secretary, F. A. Rountree, Birmingham, Ala.

April 25-26.—AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE. Annual meeting, Philadelphia, Pa. Secretary, J. P. Lichtenberger, Logan Hall, West Philadelphia, Pa.

Nov. 12-14, 1919.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, New Orleans, La. Secretary, Charles C. Brown, Bloomington, Ill.

AMERICAN ROAD BUILDERS' ASSOCIATION.

The sixteenth annual convention of the American Road Builders' Association, the ninth American Good Roads Congress and the tenth Good Roads Exhibit, held February 25, 26, 27 and 28 at the Hotel McAlpin, New York City, were very successful, the attendance being unusually large, the proceedings of value and interest, and the exhibits very helpful. On the whole it was universally agreed that the convention could be considered a good inauguration to the greatest highway construction season this country has ever seen.

The congress was called to order by president Arthur H. Blanchard in the ballroom of the hotel on Tuesday morning. Addresses of welcome were delivered on behalf of the state by Francis M. Hugo, secretary of state, and, on behalf of the city, by commissioner of public works M. L. Loughman. State highway commissioner Duffey, who was to welcome the convention on behalf of the department, was unavoidably absent. Secretary Hugo said: "We are particularly anxious now to connect the main highways of the state by completing in the best possible manner the bad stretches of road between them and which are a great detriment to efficient highway transportation. The cost is estimated at $25,000 a mile, and the highway department hopes to finish sixty miles this year." Mr. Hugo said that with the $15,000,000 remaining from the second $50,000,000 bond issue there is a total of $17,000,000 available for the New York road program, but all of the money will not necessarily be spent in one year. As an encouraging example that a reasonable supply of labor would soon be available at fair wages he cited the fact that in the previous week the highway department awarded a bid for $77,000 to complete one of the Barge Canal terminals, the estimated cost of which, based on war prices, had been placed at $99,000. Twenty-two contractors submitted bids. He also described the registration of motor vehicles by his office. He discussed the sharing of license fees with local governments and also the relation between unemployment and road building.

In an address entitled "Building for the Future" Andrew H. Phelps, secretary of the eastern district, Chamber of Commerce of the United States of America, pointed out that the increasing development of foreign trade must be aided by improved interior transportation routes. He said better roads must be provided to carry, economically and speedily, manufactured and farm products to the ports.

P. St. J. Wilson, acting director of the U. S. Bureau of Public Roads, read a paper on the "Operations of the Bureau of Public Roads Under the Federal Aid Act." He declared that the resulting benefit of the act to highway construction throughout the country had already proved its wisdom. He said that the terms of the act require efficient state departments, with the result that the departments have been greatly strengthened. At the time of the first appropriation there were seventeen states without highway departments. Now all states have them. Comprehensive programs have been submitted by most of them, and real systems have been mapped out instead of the small, disjointed sections of county highways existing before. He said that thirty-nine states have submitted adequate plans and standard specifications. He pointed out that the restrictions and difficulties due to the war had interfered with all plans. He declared that the benefits of the act had been delayed one year, but that we were now at the beginning of the greatest road building era we have ever seen. He gave statistics of projects approved and in various stages of development, and estimated that probably $100,000,000 would be used on such work this year. He said an important step toward stronger and more permanent road building was made when the government increased from $10,000 to $20,000 the amount which it would appropriate under the federal aid act toward the cost per mile. This makes it possible for the states to build good roads up to a cost of $40,000 per mile, which virtually insures the best construction for motor transport and other heavy usage. The broadened definition of "post-road" in the new post-office bill would further extend federal aid.

F. G. Macdiarmid, Minister of Public Works and Highways of Ontario, who was to have spoken on "The Highway Situation in Canada," was absent because of illness.

Tuesday Afternoon.

The opening paper of the afternoon session was "Efficiency of Bituminous Surfaces and Pavements Under Motor Truck Traffic," by Prevost Hubbard, chemical engineer, U. S. Bureau of Public Roads. He pointed out that a large proportion of pavement failures under war-time conditions, of lack of labor and engineers and of heavy traffic were complete failures, involving the simultaneous destruction of the whole structure, including the base. This, he said, proved that the wearing course can have no efficiency value in itself and that the pavement depends on the base. In this connection he discussed the question of thickness of base and the effects of weather. He pointed out that under heavy traffic internal movements in the pavement are transmitted, and that just as a slab foundation has been found necessary in city streets so it should be used on highways under heavy traffic. He declared that bituminous pavements had proved themselves efficient under modern traffic conditions if constructed with proper foundations. He cited as an example the road from Camp Beauregard to Alexandria, La. The road is of the same construction throughout, but under the heavy army traffic during the spring thaw the part outside the city was ruined in a few weeks, while within the city it stood up well. The failure, he said, was due to sub-grade conditions. Mr. Hubbard recommended the patrol system of maintenance. He said that bituminous macadam formed a satisfactory road when built on a proper base. He urged more care in distribution of asphalt in order to make pouring uniform and not too fast. He was inclined to favor hand-pouring. He emphasized the necessity of proper compacting and better aggregate grading, and favored the use of a binder course.

In the discussion of this paper F. P. Smith (Dow & Smith) declared that because broken stone has no "slab effect" he preferred telford foundations to macadam. Stone should be such as to withstand shattering effect, which had bad results. He called Topeka a "hybrid between sheet asphalt and bituminous stone mixture," and declared it to be dangerous except under very competent supervision because the smallest variation in bitumen content was liable to cause failure. He ascribed to sheet asphalt a high degree of stability. Charles H. Neal (Asheville, N. C.) thought that the danger of cracking under heavy traffic was greater in the case of concrete foundations than of macadam. Mr. Hubbard stated that the U. S. Bureau was investigating the problem of friction between concrete base and sub-grade. Further discussion, participated in by E. H. Thomes (highway department, Borough of Queens, New York), F. A. Reimer (county engineer, Essex County, New Jersey), F. E. Ellis (manager, Trap Rock & Construction Co., Melrose, Mass), and others present, emphasized the neces-

sity for care at all points during construction and that extra thickness of foundation is not always economical.

Major W. M. Acheson, division engineer, New York state highway commission, read a paper on "Present Status of Brick Pavements Constructed with Sand Cushions, Cement Mortar Beds and Green Concrete Foundations." He described the progress made in brick pavement design since 1915. He discussed cement concrete foundations. Sand cushions, he said, provided uniform bearing and resiliency under traffic, and must be uniform and compacted. He said that wetting and drying causes voids and the sand is forced up into the pavement. The more recent types of brick, which are larger and had wire cut lugs, give better construction. In the case of cement grout filler, which he said is more durable, he preferred machine mixed grout. He traced some types of brick pavement failures to the sand cushion. Taking up semi-monolithic pavements, he said this type overcomes the defects of sand cushions, such as shrinking and noise, by uniting the surface with the foundation by means of the sand-cement cushion. He said that brick of less than standard depth would prove satisfactory. He described a mechanical template operated by gasoline engine. He declared that heavy truck traffic demanded a rigid type of construction.

Discussion by Will P. Blair (vice-president, National Paving Brick Manufacturers' Association), Mr. Thomes and others followed.

In the absence of A. D. Williams, formerly chairman of the West Virginia state road commission, who was to have presented a paper on "Recent Developments in the Construction, Maintenance and Reconstruction of Cement-Concrete Pavements," the subject was informally taken up by some of the members present. W. G. Sucro (road engineer, Baltimore County, Maryland) pointed out that some concrete road failures were due to width inadequate for carrying all heavy traffic passing over the road. He said that reinforcing may be necessary at times, but he did not feel that it adds materially to strength; and on the whole, from his experience, he felt that concrete is not advisable under all conditions. C. M. Upham (chief engineer, Delaware state highway department) stated that, as a result of experimenting with reinforcing during two or three years, he had found no appreciable benefit. In the experiments reinforcing had been placed under different conditions in different slabs in the actual road. As this work was with reinforcing of only 0.2 per cent of cross-section area he could not give final opinions on greater reinforcing, which appeared to be necessary to get results.

At the request of president Blanchard, Nelson P. Lewis (chief engineer, Board of Estimate and Apportionment, New York City) described might benefit during the coming period of construction activity. The paper was discussed in an interesting way by a number of members, including Nelson P. Lewis, F. E. Ellis, F. A. Reimer and Halbert P. Gillette (editor "Engineering and Contracting").

Nelson P. Lewis, chief engineer, Board of Estimate and Apportionment, New York City, presented a paper on "The Relation Between Street and Rural Highway Systems." He declared that the time had come when the street system of a city and the surrounding highway systems should be considered as one great system rather than as separate units. It is common, he said, to have difficulty in finding the most direct route between towns or the best exit from or approach to a city. He said that lack of co-ordination is apparent in both city and rural systems. Traffic between centers of population frequently has to pass minor and unattractive streets, he said; and, on the other hand, where county or state highways leading to cities are being improved care should be given to alignment, grades, cross-section and drainage and tree planting. He then cited instances of thoroughfares through congested traffic centers in cities, which might have been avoided by planning. He discussed the question of joint improvement by state and town of state highways running through towns, and brought out both sides of the case where the municipality refuses to co-operate. His solution to the problem of securing prompt improvement of the entire trunk highway in such cases was that "the state should be able to secure this result, but without injustice to communities where the imposition of the share of the cost determined by statute would involve serious hardship." He said that power to carry out the improvement should be vested in the state, "which would become responsible for payment for the work in the first instance, and that the town should be obliged to contribute such share as may be designated by law, provided the law so specifies, with the right of appeal to some high judicial body, which would have the power either to decrease or increase the proportion fixed by statute, the decision in each case to be reached after careful consideration of all the circumstances, including population, the assessed value of real estate in the town, its existing debt and tax budget in relation thereto, the amount of traffic originating in the town, the need of other improvements, the width of its streets in proportion to their traffic, and probably other factors which would be essential to a fair determination of the issue." He ended by urging thinking in larger terms of city, state and county highway systems as only parts of a great national enterprise.

Tuesday Evening.

The Tuesday evening session was a "picture evening." The Barrett Company presented motion pictures, including construction scenes, in a film entitled "Building the Roads of a Military Cantonment." Warren Brothers Company exhibited "Columbia River Highway, America's Greatest Highway Paved with Warrenite," which displayed some of the scenic wonders of that road, as well as construction views. An illustrated lecture on "Brick Pavements" was then delivered by Will P. Blair, vice-president of the National Paving Brick Manufacturers' Association.

Wednesday Morning.

"Efficient Methods of Contracting for Highway Work During the Reconstruction Period" was the title of the first paper, which was read by John H. Gordon, president of the New York Road Builders' Association. More effective and more equitable contracts were urged in order that all parties conditions in France which he had investigated as member of a commission of American engineers, delegated to take up reconstruction problems with the French engineers. He said that, although most of the French water-bound macadam roads, which are better than those here, are in good condition, the road system would now have to be rebuilt to withstand heavy traffic and would probably be surfaced with asphalt. He said that, while the French engineers had learned some efficient methods from Americans, they were not inclined to build other types of roads, such as concrete and brick. From his discussions with French authorities he did not think that they were in a position to offer any attractive proposition to American contractors in the work of road reconstruction. He said that industrial conditions in France are unbalanced and that there was doubt as to the possibility of repopulating some of the devastated areas. He estimated the total physical destruction in France to be repaired at thirteen billion dollars.

"Cost Keeping for Highway Contractors," by H. P. Gillette, editor-in-chief, "Engineering and Contracting," was the next paper presented. (This valuable contribution will be printed in a forthcoming number. In the discussion Mr. Francis (Delaware) suggested that the cost of installing and moving equipment be included in contract estimates and prices, and Mr. Gillette agreed that such a course might prove desirable. Before leaving the platform Mr. Gillette expressed his indignation at the common references by newspapers to the federal road aid legislation as "pork-barrel" measures. He urged that all present should take up such references with the editors and educate them out of careless and ignorant views in confusing highway aid with post-office and similar appropriations.

A. D. Williams, former chairman of the West Virginia State Roads Commission, supported Mr. Gillette's protest, and then discussed the topic

which he was to have presented the previous afternoon—"Recent Developments in the Construction, Maintenance and Reconstruction of Cement-Concrete Pavements." He reviewed developments in methods and recounted his experiences. In speaking of joints he recommended the submerged or invisible ones. He described the decided development in surface finishing methods in the past three years leading up to the most effective method—the Macon roller. In regard to reconstruction, he foresaw an increasing tendency to resurface old concrete with 2½-inch or 3-inch second tops. In making repairs he advised that defective parts be cut out and replaced by concrete of the same mix. He urged care in getting cracks perfectly clean before using tar or asphalt compositions for repairs. The colorimetric test of fine aggregate, he said, opened up a wider range of available materials, and cited the use of sandstone in West Virginia, which had before been considered impracticable, but which was found to give a better surface than gravel. He looked forward to new developments, and particularly turned to mechanical engineers for new machines.

"Foundations for Heavy Horse-Drawn and Motor-Truck Traffic" was the subject of a paper, illustrated by stereopticon pictures, by C. M. Pinckney, chief engineer of highways, Borough of Manhattan, New York City.

Colonel W. G. MacKendrick, road engineer for the fifth British army in France (formerly president of the Warren Bituminous Paving Company, Toronto, Ont.), was requested by president Blanchard to recite some of his experiences. In a vividly colorful and highly entertaining narrative Colonel MacKendrick told of road construction near the firing line and the difficulties of maintenance under terrific army traffic. He was of the opinion that light railways, as used extensively by the Germans, were better than continuous highway construction near the front. Finding it impossible to build ordinary roads over shell-hole areas he finally was able to construct effective roads of planks, covered with macadam top.

Wednesday Afternoon.

"Economic Utilization of Labor-Saving Road Machinery," by Charles M. Upham, chief engineer, Delaware state highway department, was the first paper at this session. It was illustrated by stereopticon pictures. The paper took up more specifically equipment and methods in connection with concrete highway construction, including machinery for mixing, laying, finishing, handling materials, etc. Many of the illustrations were construction scenes on the well-known du Pont road in Delaware.

A progress report was then presented, and accepted by the convention, by G. P. Coleman, state highway commissioner of Virginia, and chairman of the committee on "Convict Labor on Highway Work: Organization, Administration, Camps and Cost Data." He described convict labor practice in his state and suggested principles. He advised that the superintendent of work and the sergeant of guards be one man in order that disciplinary and work conditions be controlled by him rather than under dual authority of representatives of both the prison and highway departments. Sanitary arrangements on Virginia work are under the state board of health. Commissioner Coleman was in favor of convict labor because of its good effects on the men, as well as the benefits to the state. That the men become good workers he proved by the fact that 25 to 30 per cent. of discharged prisoners are employed by highway contractors. He urged that all able-bodied convicts should be given work on the roads and that the highway department be invested with all authority over them. In Virginia the men are divided into four classes, according to character, offense and term of sentence. The convicts are paid ten cents per day (at the end of their terms).

A letter was read from Dr. E. Stagg Whitin (chairman of the executive committee of the National Committee on Prison Labor), a member of the committee. Dr. Whitin urged that convicts be paid reasonable wages, equal to those of free labor. Commissioner Coleman disagreed with this view. E. E. Reed (assistant state highway engineer, New Jersey) described conditions in his state, where some convict labor has been used since 1912. This year the department will prove to the labor unions that convicts are being paid a rate equivalent to that of free labor. The overhead cost (including maintenance) to the prison department amounts to $1.50 to $1.75 per day per man, and to the highway department the overhead cost is twenty-five cents a day. Convict labor is considered 50 per cent to 100 per cent. efficient (average of 75 per cent). With a free wage scale of $3 a day convicts are therefore worth $2.25, and deducting $2 costs, twenty-five cents per day is left as allowance.

Paul D. Sargent, chief engineer of the state highway department of Maine, then presented a report as chairman of the committee on "Sources of Supply of Unskilled Labor for Highway Work." (This valuable report, already the subject of an editorial in Municipal Journal of March 1, will be printed in full in a later issue.)

Discussion on this report was opened by Leslie Willis Sprague (U. S. Department of Labor.) He declared that during the present period of readjustment there is need for "buffer" employment and that highway work is most favorable for this. Foreseeing a period of labor shortage when work is really resumed, he urged that all available labor be used now; but warned against making work simply for the sake of making it. He appealed to the patriotism of employers and public officials to hasten resumption of normal labor conditions.

Wednesday Evening.

This session was devoted to the annual dinner of the association, which was held at the Waldorf-Astoria Hotel. It was a stag dinner affair, with redeeming features of no after-dinner speeches and no formal dress. General T. Coleman du Pont, who was chairman of the local entertainment committee, presided. After the dinner there was a well-received vaudeville show. Between six and seven hundred were present at the dinner.

Thursday Morning.

A joint session of the American Road Builders' Association, American Automobile Association, Highway Industries Association and the National Highway Traffic Association was held Thursday morning, at which the reports of committees were received.

Willis Whited, bridge engineer, Pennsylvania state highway department, as chairman presented a report on "Methods of Strengthening and Reconstructing Highway Bridges for Heavy Motor-Truck Traffic." (This report will be reprinted in a forthcoming issue.)

The report of the committee on "Reconstruction of Narrow Roadways of Trunk Highways with Adequate Foundations and Widths for Motor-Truck Traffic," presented by the chairman, H. E. Breed, first deputy highway commissioner of New York, was followed by interesting discussion. It was recommended that in widening roads the widening strips should have the same foundation and same depth as the rest of the road. Mr. Blair (Paving Brick Manufacturers' Association) was of the opinion that the maintenance of road sides cost more than that of the wearing surface. Commissioner Sargent (Maine) gave illustrations of this point from experiences in his state. Three-foot macadam shoulders on a concrete pavement had cost $250 per mile annually on one road and $200 on another. He found that one foot of additional width on a sixteen-foot road would reduce the maintenance to practically nothing. He said that the main damage was caused by the outer wheel of each line of traffic.

George H. Pride, president of the Heavy Haulage Company, as chairman, presented the report of the committee on that vexed question, "Regulations Covering Speed, Weight and Dimensions of Motor Trucks." The report was brief, merely stating that because three of the engineer members of the committee came from states where the legislatures were considering bills contradictory to the opinions of the majority of the committee and could therefore not concur, no regulations were adopted by the committee after months of labor. The report started one of the liveliest discussions of the

convention, and Mr. Pride, with excellent good humor and keen replies, was kept busy from the floor. The members present felt that definite regulations should be adopted by the association and used for educational purposes among the legislators considering the subject. They began then and there to thresh out the whole matter. The relation between manufacturer and user was discussed, and Mr. Pride pointed out that the manufacturer would make only those trucks which the user found it economical to use. He said that the transportation business is new and small, and that a line between New York and Boston, for instance, would be possible with 7½-ton trucks and not with 5-ton. He foresaw increasing use of large trucks with high tonnage by farmers, and that weight limits less than 28,000 pounds would mean inadequate transportation. He said that at present trucks are being overloaded 50 per cent and highways are being worn faster than if 7½-ton trucks were permitted. George C. Diehl (chairman, Good Roads Board, American Automobile Association) pointed out that different roads can carry different loads, and that if load is limited traffic would be increased; that doubling width cost more than doubling carrying capacity. Mr. Pride presented the majority maxima for truck regulations, and these were taken up by the members. Mr. Whited (Pennsylvania) urged that distribution of load two-thirds on rear axle and one-third on front be required in order to safeguard the bridges. Mr. Pride answered that trucks were not built that way. At the suggestion that excess license fees be levied on very heavy trucks to make such transportation prohibitive, Mr. Pride declared that the case was not one between truck manufacturer and highway builder, but was "the people vs. the people." He said that illiberal limitations on trucks would result in higher costs of transportation, and consequently higher costs of food and other products. Major Frederic A. Reimer (county engineer, Essex County, N. J.) urged that the meeting go on record as favoring the incorporation of the standards in the New Jersey motor vehicle law in the association's standards, since the former were similar to those in the committee's report. President Blanchard pointed out technical objections to this course. Mr. Pride declared that the New Jersey law is not enforced, and was unenforceable because it did not conform to truck construction practice. Mr. Diehl presented the standards of the committee in the form of a resolution, which was referred to the resolutions committee.

Thursday Afternoon.

The second joint session was opened with a motion picture, "Ocean to Ocean by Motor Truck," by H. S. Quine, secretary to the president of the Goodyear Tire & Rubber Co.

George H. Pride, formerly a member of the Highways Transport Committee, Council of National Defense, read a paper on the "Inter-Relationship of Highways, Railways and Waterways," in which he enumerated the functions of each mode of transportation, and urged that the problem of transportation be considered comprehensively.

"National Highways" was the subject of an address by General T. Coleman du Pont, chairman, Board of National Councilors, National Highways Association. He made a plea for highways of national scope and national value.

Edward J. Mehren, editor, "Engineering News-Record," presented the report of the committee on "National Highways," dealing with a federal highway commission and a federally controlled highway system.

Following the session, a number of members accepted Commissioner Loughman's invitation on behalf of the city to take 'bus inspection trips to scenes of interesting public work construction.

Thursday Evening.

This was a motion picture session. The Granite Paving Block Manufacturers' Association presented "Production and Construction of Granite Paving Blocks and Curbs." The Koehring Machine Company showed a film illustrating "Modern Methods of Grading and Handling Materials." "Good Road Building" was the title of a film exhibited by E. I. du Pont de Nemours & Company.

Friday Morning.

Chairman H. G. Shirley, secretary, Highway Industries Association, presented a report of the committee on "Civil Service Requirements for Highway Engineering Positions."

"Efficient Methods of Promoting Highway Bond Issues" was the subject of a paper by S. E. Bradt, state superintendent of highways of Illinois, which gave valuable practical advice to those concerned with educating the public to highway needs.

Nelson P. Lewis, chief engineer, Board of Estimate and Apportionment of New York City, presented a report of the committee on "Methods of Financing Highway Improvements for States, Counties and Towns." The report advised more careful and conservative methods of financing in order that the burden be equitably distributed.

The report of the committee on "Economic Status of Guarantees for Pavements on Roads and Streets" was read by the chairman, Francis P. Smith, and discussed by George C. Warren, G. M. Ingram, F. A. Reimer, A. P. Folwell, F. E. Ellis and others. (This report is printed in this issue.) Mr. Warren advocated a life of guarantee covering not the reasonable life of the pavement, but one sufficient to detect poor workmanship. Failures due to conditions not within the contractor's control are the most common cause of contention between cities and contractors and bonding companies. He claimed that the contractor must add to his bid more than the mere cost of securing a bond, several times this being necessary to cover the uncertainties involved in guaranteeing. Retaining 20 per cent of the payment, he insisted, was disadvantageous to both the city and the contractor. Mr. Ellis stated that his firm was so opposed to guarantees that it would take no work where they are demanded. Mr. Reimer also questioned the advisability of guarantees, and thought that engineers generally were coming to this opinion. Mr. Folwell stated that of 100 city engineers in all sections of the country 45 favored guarantees, 35 were opposed to them and the remaining 20 expressed no opinion. (The details of opinions from several hundred engineers will be given in Municipal Journal probably next week.) What cities wanted was not the contractor's money, but absence of necessity for repairs, and that plan was best that would best accomplish this. Mr. Winslow stated that in some states, at least, cities cannot be sued and the contractor cannot recover a retained percentage by legal action. Questions by president Blanchard brought out that New York and some other, if not all, states were similarly protected against law suits, but that they can be sued by consent of some state authority, and this probably never would be denied if there was any shadow of a just claim. The report of the committee was accepted as a progress report, without any vote being taken on the adoption of its ideas.

Friday Afternoon.

The session opened with an interesting illustrated lecture on "The Motor Vehicle in Warfare" by John R. Eustis, secretary, Motor Truck Board, American Automobile Association.

The report was then presented of the committee on "Uniform Highway Signs," of which Robert A. Meeker, consulting engineer, Newark, N. J., was chairman. Standard signs as adopted by the county engineers of New Jersey were shown and discussed.

The report was presented of the committee on "Efficient Methods of Snow Removal from Highways Outside of Urban Districts," of which Charles J. Bennett, highway commissioner of Connecticut, was chairman. Captain J. A. Duchastel, city engineer, Ontremont, Canada, discussed methods in his town, and described a successful machine developed recently.

Frederic E. Everett, commissioner of highways of New Hampshire, read a paper entitled "Methods of Maintaining Highway Systems Prior to Construction by the State or County." Various methods were described and practice in a number of states discussed.

(An abstract of Mr. Pinckney's paper on "Foundations for Heavy Horse-Drawn and Motor Truck Traffic," the full text of the resolutions adopted by the convention, and a list of exhibitors, will be published next week.)

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